MR. CHADWICK ON WANT OF SCIENCE IN OUR PUBLIC WORKS.

The week before last we mentioned the annual meeting for the distribution of prizes at the College for Civil Engineers, Putney, but from pressure of matter, were unable to do more than allude to the address of the Principal. We now return to it, and have the pleasure of placing before our readers a correct and, we believe, exclusive report of a speech made by Mr. Edwin Chadwick on that occasion, touching many points of much interest.

Mr. Chadwick said he had not been led to expect that he should be more than a silent witness of their proceedings, yet he could not hesitate to offer testimony to the great public importance of the promotion of the studies in practical science, for which the college was specially instituted. This country was pre-eminent for its great expenditure in public works, for its stores of practical science available for their direction, yet whenever a large proportion of those works were examined in their conception, their execution and the effects realised in comparison with the expenditure upon them, they too frequently failed to justify any claims to pre-eminence in the application of that science. In respect to one important class of works, the condition and effects of which it had been his duty to examine—the works for the sewerage and drainage of the metropolis and of other of our large towns, which had been frequently pointed out as a subject of public boast, but on irrefragable proof he had been compelled to pronounce them to be a vast monument of mal-administration, of lavish expenditure, and of defective execution, and this conclusion further inquiry had only served to confirm in every particular. That very form of sewers which had been presented to a committee of the House of Commons by a gentleman of high professional standing, as the most perfect in its form and connected arrangements that had been or could be attained in practice (the form with upright sides, nearly flat segmental bottoms, and spreading footings), was found to accumulate deposits of decomposing matter, and pollute the air of their houses and the streets with offensive and pestilential emanations. That form he had adduced as an example of weak, unscientific, and most expensive construction. Line after line of the sewers of this expensive construction had since fallen in in one large district, and its use was therefore silently abandoned. Now in the second volume of first report of the commissioners for inquiry into the health of large towns they would see in the admirably clear evidence of their professor of geodesy, Mr. Butler Williams (which he ventured to commend as a most important subject of their professional study), the demonstration that by a sewer of another and scientific construction, the egg shape, with precisely the same number of bricks three districts might have been sewered perfectly for the money lavished in sewering one, and that one imperfectly and injuriously. Their professor had demonstrated that all this waste of money, which though no less than 60,000*l.*, was levied in excess during ten years on the ratepayers in that one district, was of secondary importance to the noxious effects on the health of the population, must have been avoided had the works been planned and executed by persons who had gone through a proper course of study, and duly consulted such works as those of Young and Tredgold and others, containing the existing knowledge, to be found on the shelves of their college library. On inquiry into the history of a large proportion of these wasteful and deplorably inefficient works of our towns, it appeared that they had been superintended by ignorant authorities, and designed and executed piece-meal by common tradesmen, who did not understand the use of the spirit-level, and nothing more fully proved the ignorant reckless temerity with which such works were conducted than the defective nature of their plans, and often the entire absence of any plans or survey whatever. In one district, where a commissioner happened to deem it a qualification for the office of surveyor and succeeded in getting it recognised, and where, as a consequence, a properly qualified person happened to obtain the appointment, it was proved in a recent report of that same engineer that no less than one-quarter of a million of money must be expended for setting right the outfalls of the sewers of that one division (the Holborn and Finsbury) of the several divisions into which the general sewerage and drainage of the metropolis had been capriciously, ignorantly, and mischievously divided. Now he, Mr. Chadwick, ventured to assert without fear of disproof, that had the district which he had named or others, been originally placed under the guidance of any person who had gone through such a course of studies as the course provided in that college, with competent attention to their duties, it was impossible that such misery and waste could have been inflicted; a waste of capital in respect to levels only in that one district, which would, under proper direction, have sufficed for the complete drainage of upwards of 50,000 of the houses in the metropolis that are still left without any proper drainage. As a convincing proof in itself of the reckless or ignorant temerity with which such large expenditure in such important public works had been, and still continued to be made, it might suffice to state that neither in the metropolis, nor in any of the towns examined, was any accurate map with proper system of levels found to exist. Hence they saw large sewers which after all that had been expended on them were found with accumulations of stagnant refuse, acting as extended cesspools. To shew what might be done for amendment, he had asked and had obtained the aid of a detachment of the pupils of that college, and under the superintendence of their professor of geodesy, they had executed as a specimen the first plan of the city of London, and he believed of any town in Great Britain in which contour lines of equal altitude were laid down. That map (which had been followed by another specimen map of Windsor, executed under the direction of the Board of Ordnance) he displayed before the noble chairman, and stated that he had been assured by competent engineers, that if similar maps with contour lines had been executed for the whole country, that out of the two hundred and forty millions of probable expenditure for the railways to be constructed in this country, full twenty millions would be saved by the better direction which it must have given to the works. Lord Devon observed that he was fully impressed with the great importance of such well-constructed maps, with levels so exhibited, for the guidance of all such works, and he had used great exertions to obtain a map of Ireland with the contour lines, which would be found appended to the recent report of the commission of inquiry into the tenure of land in that country. With such a map, any one sitting in his own room might see what would be the best lines of drainage. Whilst the sewers and the general drainage works of large districts were found to have been executed without the rudimentary knowledge available for the efficient construction of such works, large masses of capital were expended in works for the distribution of water into our towns without such a competent knowledge of hydraulics, and other branches of science applicable to the collection, storage, purification and distribution of water, as a good scientific course of instruction must afford. Some of the consequences of this empiricism were, that after all the ill-advised and lavish expenditure of the companies' capital, the adoption and maintenance of intermittent supplies of water necessitating a double and treble expenditure on the part of tenants; the retention of water in butts and tanks in which it stagnates until it is wanted, and absorbs the dust and soot, and vitiated atmosphere, preventing improvements in the application of water to an efficient system of house drainage and cleansing, and the immediate extinction of fires, and the preservation of life as well as property. The course of the sanatory inquiry, and the examination of schools, and workshops, and large public as well as private buildings, shewed that they had been constructed by professional men, who from the condition of those buildings when occupied, and the sufferings of those who were kept in them, were demonstratably ignorant of such a practical knowledge of the settled principles of pneumatics, and the existing practical science applicable to warming and ventilation, as must have led to relief by arrangements for the properly regulated ingress of air, that was warmed as well as pure, and for its egress when vitiated. He might occupy the whole day, and fail to adduce all the proofs which indeed filled the volumes of reports now before the legislature and the public. In them were to be seen the grounds on which the commissioners of inquiry, at the head of which was the noble duke, the president of the college, came to the concurrent and unanimous conclusion, in solemnly recommending to the legislature that securities should be taken for the public safety, that all such works should be superintended as well as planned by men of tried competency as engineers, from the possession of such science as the founders of that institution were anxious for the public advantage to impart. But it was not in those volumes that the public need seek proof, in waste of life and property, of the deplorable deficiences of practical science for which public provision and securities were requisite. The proofs were displayed to them in spectacle after spectacle of the ruins of fallen bridges, factories, and large buildings, in horrible deaths, and shocking mutilations occurring again and again from the like preventible causes. From the direct information of competent inquirers, as well as from the published evidence, he might confidently assert, that where full inquiry was made, there was not one recent instance of such destruction in which the cause was not assignable and distinctly assigned to a culpable omission of the application of existing knowledge or science. In the instance of the failure of one edifice, he was assured upon competent authority, that the cause of the destruction, attended by loss of life, was occasioned by the breaking of a sound bar of iron, just of the size at which the architect, if he had consulted the works of Tredgold, would have found it shewn on actual experiment that such a bar would break under such a weight as had been ignorantly placed upon it. In another instance, of the destruction of life from the falling of a factory, the cause was clearly proved to be the unskilful disposition of some eleven tons of weight on iron beams, which existing *data* with respect to the strength of materials, imperfect as those *data* were acknowledged to be, if they had been duly consulted in the plans and in the construction of the works, would have shewn could only have been safely intrusted with a much less weight skilfully adjusted. Another instance of destruction was displayed in the breakage of a cast-iron beam, the crushing of brick, stone, and iron successively; in the order in which it was laid down in existing works, such materials of such dimensions must be crushed when charged with such weights. On the other hand, reckless empiricism and ignorance of the strength of materials found safety in the wasteful application of them and massive deformity, which was the subject of complaint as well as the consequent excessive expense of our public works. Again he ventured to repeat, that the task of retrieving these and the like proved errors, the effectual drainage of towns, of habitations, and agricultural districts, the most effectual prevention of those atmospheric impurities, the causes of epidemics and of premature mortality, was only to be achieved when such practical science as it was the object of this institution to promote and diffuse, was duly appreciated and received by the public, and properly applied.—(Applause.)

Dr. Lyon Playfair stated from his own observations, as a commissioner of inquiry, he could corroborate the statements of Mr. Chadwick in respect to the deplorable absence of competent scientific knowledge displayed in our public works, especially in his observations on the want of knowledge of science displayed by builders and architects in their arrangements for ventilation. In the schools which he examined in Lancashire he found that from the space allowed for air to breathe (and the absence of any arrangements for changing it) was only one-half that in which they could breathe it without change, and were compelled to breathe repeatedly the same vitiated air, and that hence arose various forms of disease, and that their constitutions were impaired for life.

Mr. Bandaor addressed to the students instances to shew that what was set down as intuitive genius was commonly the result of greater mental application, and that labour was the best foundation for professional eminence.

Mr. Binnell bore his testimony to the practical utility of such studies as those pro-

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